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A model for liquid film in steam turbine AMELIE SIMON, EDF R&D, 78400, Chatou, France / LMFA 69134, Ecully, France, MERYEM MARCELET, EDF R&D, 78400, Chatou, France, JEAN-MARC HERARD, EDF R&D, 78400, Chatou, France / I2M, UMR CNRS 7353, F13453 Marseille, France, JEAN-MARC DOREY, EDF R&D, 78400, Chatou, France, MICHEL LANCE, LMFA 69134, Ecully, France — Wetness in steam turbines induces losses and erosion. Drops are created due to the fast expansion of the steam (homogeneous nucleation) and the impurities in the steam (heterogeneous nucleation). The droplets grow and some among them settle on the blade leading to a thin liquid film. This film may then be atomized into coarse water drops which crash on the following blades. The liquid film configuration is a thin film on a curved surface, created by the drop deposit and under high steam friction. In steam turbines, the liquid film is subject to high rotational effect (rotor) and/or to negative gravity. Moreover, due to interfacial instabilities, some drops are torn off from the film. The retained approach is an integral formulation of the Navier-Stokes equation (or shallow water equation) with specific terms. The derivation of these equations requires some closure laws for the convection contributions, the Coriolis terms and for terms related to the additional mass coming from the drops deposit. Once chosen, mathematical and mechanical analyses are performed (hyperbolicity, entropy, galilean and rotational invariance). A two-dimensional code has been developed based on finite volume method to simulate numerically this liquid film model for steam turbines.

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